is very curious to find a compendium of logic with the syllogism left out. Hamlet is even less necessary to his play than the syllogism to logic. It is true, however, that the syllogism is an easy matter compared with inversion and contra-position. There is hardly a boy who is not greatly surprised to find that when he has proved that an isosceles triangle has two equal angles, it still remains to be proved that a triangle having two equal angles is isosceles. As De Morgan has pointed out, Euclid himself was apparently not aware that it follows every time from *A implies B* that *non-B implies non-A*.

In regard to 'his rule of inversion,' when three or more propositions are involved, Mr. Halsted has fallen into a slight inaccuracy. In the first place, if the term 'contradictory' is to be applied to three terms at all, it should be used in the same sense as when applied to two terms; the three terms should together cover the whole field, and they should not overlap. The word is a bad one for this purpose, however, and it is just as well to keep the two properties — that of being exhaustive and that of being incompatible — distinct.

In the second place, there is a redundancy in the rule as given by Mr. Halsted. From the three propositions,[1]

X implies x,
Y implies y,
Z implies z,

it may be inferred that

x implies X,
y implies Y,
z implies Z,

provided that *the subjects cover the whole field, and the predicates are incompatible.* It is not necessary that the subjects should be known to be incompatible, though it follows from the premises given that they are so, but also that the predicates are exhaustive. From the first two we have

X Y implies x y;

and, since there is no x y, there cannot be any X Y either.

It is very well worth while to have formulated the reasoning involved, instead of going through all the separate steps every time there is occasion for it, as the usual books on geometry do.

The conclusion does not follow if it is given that the subjects are incompatible, and that the predicates together fill the universe. The nature of the argument is most clearly seen in space. Lange believes that the logical laws of thought are derived from space-conceptions. Suppose there is a table painted in various colors, but so that

the red is all in the violet,
and the yellow is all in the blue,
the orange is all in the green;

and suppose, also, that the red, the yellow, and the orange together cover the whole table, and that the violet, the blue, and the green do not overlap: it follows that

red = violet,
yellow = blue,
orange = green.

To show how a somewhat complicated argument can be simplified by having this type of reasoning at command, we add a real illustration from algebra. In Descartes' method of solution of the biquadratic equation, the following relations are seen to hold between its roots and those of the auxiliary cubic: —

Roots of the biquadratic.		*Roots of the cubic.*
All real	*implies*	All real and positive.
Two real (unequal)	*implies*	One positive, two imaginary.
Two real (equal)	*implies*	One positive, two equal negative.
All imaginary	*implies*	One positive, two unequal negative.

But the division on the left is exhaustive, and the classes on the right are mutually exclusive: hence, by a purely logical *tour de force,* these propositions can all be inverted, and the desired inferences *from* the roots of the cubic *to* the roots of the biquadratic can be obtained at once.

Mr. Halsted's reviewers have pointed out before that he is deficient in a certain natural and becoming modesty. 'Two formative years' of his life is too high-sounding a phrase to be applied to any but a very great mathematician, like Professor Cayley, for instance.

[1] The letters stand for either terms or propositions.

CEREBRAL EXCITABILITY AFTER DEATH.

The problems of brain physiology are so complex, and our means of studying them, especially in the human subject, so insufficient, that it is not to be wondered at if rather out-of-the-way and venturesome experiments are sometimes undertaken by the anxious physiologist; as, witness the actual stimulation of the exposed brain in a patient whose death seemed certain. Such an experiment is not apt to be repeated; and a few French physicians have now wisely set to work to study the results of stimulating the cerebrum, exciting the sense-organs, and subjecting the whole body to a vigorous examination in the case of criminals who have suffered death by decapitation.[1] Such investigations are not new; but the results have been, as a rule, either entirely negative, or brought out only a few rather obvious facts. In the experiments about to be described, the methods

[1] *Revue scientifique*, Nov. 28. By J. V. Laborde.

of experimentation have been much improved, mainly by keeping up the spark of life, artificially, for a much longer time than was ever before accomplished.

A dog was prepared in such a way that a transfusion of blood from its carotid artery to one of the carotids of the head of the decapitated criminal could be promptly made, and thus a supply of living blood be made to flow through the lifeless head, and thereby preserve the excitability of the nervous apparatus. Into the other carotid (the right) of the head defibrinated blood at a suitable temperature could be injected. The head was received seven minutes after decapitation. The difficulty of finding the carotids in the soft tissues, which had become sadly disfigured by the decapitation, caused a loss of ten minutes. A small opening in the cranium was then made, so as to insert a pair of electrodes on the frontal parietal region of the left side, — the presumable motor centre for the facial muscles. At about twenty minutes after decapitation the double transfusion of blood was begun. The result was striking : a bright color returned to the face, which also assumed a natural expression. The effect was most marked on the left side, which received its blood-supply direct from the dog. The electrodes were inserted, but no result followed. Thinking this might be due to a stimulation of the wrong spot, they made another opening in the skull, and again stimulated the brain. This was followed by a regular and marked contraction of the muscles of the *opposite* side of the face, involving the orbicular and the superciliary muscles, together with a movement of the lower jaw, causing a strong chattering of the teeth. This effect could be repeated at will up to the 40th minute after decapitation, and, by increasing the current used in stimulation, to the 49th minute. After this no movement followed the application of the electrodes, although the facial muscles could be made to contract by direct stimulation of the muscles. The failure of the first stimulation was afterwards shown to be due to the unusual length of the head, thus causing an error of a few millimetres in the localization. At first the pupil could be made to dilate and contract by the approach or withdrawal of a strong light, — a fact frequently observed in previous cases. The peculiarities of the case are the great length of time for which the excitability remained, and the means employed for preserving this excitability, namely, the transfusion of living blood.

An opportunity of verifying these results presented itself in a subsequent case, but the results of cortical stimulation were negative. The explanation was offered, that the individual had furiously resisted the attempts of the officers to put his body in position for decapitation, and that the resultant neuro-muscular excitability prevented the orderly action of the electrical stimulation. However, a few new results were obtained. In the first place, the patellar or knee reflex, obtained by striking the tendon, was distinctly observed on the body. The contraction was perfectly normal. Another remarkable result was this : the cephalic end of the medulla was stimulated in hopes of exciting the nucleus of the hypoglossal nerve. The attempt was successful, and movements of the tongue such as follow direct stimulation of the nerve were distinctly observed.

Physiologists have not been very sanguine of results from this method of research ; but it seems that its importance has been rather underestimated. It will never be available for original investigations ; but it will serve as a means of verifying results otherwise obtained, and makes the inference from the facts with regard to animals to similar conditions in man more reliable.

PARASITISM AMONG MARINE ANIMALS.

IT is a curious fact that nearly all well-defended marine animals are either brilliantly colored or otherwise attractive, as in the case of the sea-anemone, jelly-fish, and tropical shells and crabs. Those with little or no defence are generally inconspicuous, or resemble surrounding objects. This may be explained by supposing that by being inconspicuous they easily escape the notice of their enemies. Brilliant, well-defended animals have little fear of enemies, and by their bright colors attract curious animals within reach of their deadly powers.

Many a fish in the sea instinctively avoids the deadly power hidden behind the brilliantly phosphorescent jelly-fishes. This protective light has saved the jelly-fish much trouble, and is a great aid to it in its struggle for existence among the multitudes of surface animals. Through some curious freak in evolution, an entirely inoffensive cluster of animals, devoid of any protective power, has gained the use of this phosphorescent light, and, by imitating the dangerous jelly-fishes in this respect, sails about the surface, inspiring terror among surface animals that could easily devour them. This cluster of animals is Pyrosoma. In the clusters of floating seaweed in the Gulf Stream there are vast numbers of tiny fishes attired in the color of the floating weed, and that certainly gain protection thereby.

The lump-fish has a sucker on its body by which it can attach itself to some fish of a similar